

NOTES

To Build a Nation

¹At first practical and eclectic, partaking of selected practices and theories of the Europeans, American engineering began in the 1830's to assert a native character through construction of the transportation systems and development of the techniques which would become the tools of the industrial revolution. The American method stands out uniquely by the colossal scale of its works and by its pursuit of techniques to improve the general life style proliferated through mass production.

²Formally established by Congress in 1779; commanded by General Louis LeBegue DuPortail.

³Etienne Rochefontaine, who had served under DuPortail 1778-1783.

⁴Jonathan Williams, Joseph G. Swift, Walker K. Armistead, Alexander Macomb, Charles Gratiot, Joseph G. Totten and *John J. Abert (*Chief, Corps of Topographical Engineers).

Insignia of the Corps

¹R. B. Buzzaird; Insignia of the Corps of Engineers, the Military Engineer March-April 1950 and January-February 1958.

The Delaware Breakwater and Ice Breaker

¹Construction authorized by Act of Congress, approved 23 May 1828.

²" And I entirely concur in the opinion expressed in your letter of the 22nd of December last, that the more contracts we have the better we shall be served." QMG to Maj. Geo. Bender, QM, Phila.

³William Strickland—(1787-1854) Architect-Engineer. Founder and first president of the American Institute of Architects. Designed: First U. S. Mint, Phila.; Restoration, Independence Hall, Phila. (1828); Merchant's Exchange, Phila., Walnut & Dock Sts (1832-34); Merchant's Bank (now Norwegian Seaman's Church) Phila. 3d South of Market, originally Mechanic's Bank; St. Paul's, Phila. (rebuilt) So. 4th Street; Capitol Building, Nashville, Tenn.

⁴Samuel S. Southard, Secretary of the Navy; President John Quincy Adams

⁵Maj. Gen. Thomas S. Jesup, QMG.

⁶"It is due to candor to inform you that, valuable as your services unquestionably have been, I have never since the first years' operations considered them necessary. There are many officers of the Department fully qualified to direct every operation at the work, with compensation not much exceeding one half that which you have received." (\$3,500 per annum) QMG to Wm. Strickland, Esq.—Letter dated 24 July 1834.

⁷QMG to Henry Myers, Esq., Chester, Pennsylvania.

⁸Hon. Lewis Cass.

⁹Letter to Maj. Bender, Quartermaster at Philadelphia, 4 May 1830.

¹⁰Report of Major J. G. Barnard, Corps of Engineers, 1853.

¹¹Major Delafield, Corps of Engineers, proposed closure in 1836.

¹²8 October 1853—Chief of Engineers Annual Report.

The Chesapeake and Delaware Canal

¹“What they did not understand they conquered by diligent study, unwearied zeal and sound common sense;” Desmond Fitzgerald, President, ASCE.

²Albert Gallatin, born in 1761, Geneva, Switzerland. Came to America in 1780; appointed Secretary of the Treasury by Thomas Jefferson in 1801.

³C & D: Surface width 66 ft., bottom width, 36 ft., depth, 10 ft. Erie: Surface width 42 ft., bottom width, 28 ft., depth, 4 ft. (later enlarged)

⁴Greville Bathe in “An Engineer’s Miscellany,” quoting Mr. Toward Nevison Loraine, C & D Canal Engineer, 1900-1927.

⁵Highest annual number of passages through the Old Lock Canal was 16,394.

⁶Samuel Vaughan Merrick started Southwark Foundry in 1836 at Washington and Federal Streets in Philadelphia. Originally a foundry for castings, it developed into a first class machine works; was among first to use the Nasmythe steam hammer. Work force averaged 350 to 500.

Ice Harbors

¹The purpose of the ice piers, to make a safe and secure harbor for vessels against running ice, should be considered in the light of conditions prevailing in the early 1800’s. A majority of the vessels plying the Delaware prior to the Civil War had wooden hulls; early navigation was wind-powered. Before a proper channel was made, large vessels under sail needed the high water of two tides and the right wind to run up to Philadelphia from the bay. Harbors of refuge equipped with ice piers along the route were welcome indeed. Running ice could strain and crack wooden hulls, could sweep vessels off course and cause them to founder.

²Legend on a Plan of the Harbor of New Castle, Delaware, 23 June 1854.

³Richard Delafield; became Major general; Chief of Engineers, 1864-1866.

The Upriver Canals

¹Incorporated 2 April 1811 as the Union Canal Company of Pennsylvania. The name signified the union of two predecessor companies established for the same route: Schuylkill and Susquehanna, chartered 1791 and Delaware and Schuylkill, chartered 1792.

²The Union Canal was finally built between 1821 and 1827.

³“This company was declared to be hopelessly insolvent in March, 1855, in a legal report filed in a Philadelphia court, which recommended that it should be sold at Sheriff’s sale”—Ringwalt’s transportation systems in the United States.

⁴Hydraulically operated sluice gates, an invention of Josiah White, were dubbed “Bear Traps.” The name is said to have originated in the facetious reply of a dam builder to a curious native who asked what he was building.

⁵Asa Packer 1805-1879. Born, Mystic, Conn. was a carpenter in New York City; made a fortune building canal boats and locks and investing in railroads; was Carson County Judge 1843-1848, member House of Representatives (Pa.) 1841-1842 and member, House of Representatives (National) 1853-1857. Founded and endowed Lehigh University.

⁶Delaware Division, Pennsylvania State Canals.

⁷Most active and meritorious in supporting the Canal's preservation has been the Delaware Valley Protective Association.

⁸Highest was the Pennsylvania Main Line (Mixed System). Its Portage Railroad between Hollidaysburg and Johnstown rose 2,291 feet to traverse the Allegheny divide. Second highest was the Delaware and Hudson—El. 972.5 feet at Honesdale, Pa.

Rebuilding Fort Delaware

¹The National Road was begun in 1811; its original route was between Cumberland, Md. and Vandalia, Ill. The first federally supported interstate highway system, its construction was suspended due to extension of long line railroads. Also known as the Cumberland Road and the Great National Pike.

²Major General Joseph G. Totten, Chief Engineer 1838-1863; became first "Chief of Engineers" when Corps of Engineers and Topographical Engineers consolidated, 3 March 1863.

³Jean Victor Poncelet, 1788-1867 born Metz, France; General of the French Army and mathematician; author of "*Traité Des Propriétés Projectives Des Figures*;" considered a founder of modern geometry.

⁴Considerable doubt still remained as to the feasibility of erecting a heavy masonry structure on the Pea Patch mud bar. Many persons in and out of government remembered the unfortunate and expensive result of the first Fort Delaware project.

⁵Thomas Lincoln Casey, graduated Number One, Class of 1852, West Point; became Brigadier General; was Chief of Engineers 1888-1895.

⁶The Leiper Quarries on Crum and Ridley Creeks in Pennsylvania were owned and operated by the Leiper Family since about 1790. These quarries supplied much of the stone for the Delaware Breakwater and great quantities of curbstone, paving and building stone for the city of Philadelphia.

⁷Four piles were covered with a typical grillage platform; stone was piled on to equal a proportionate wall bearing load. After a year it was observed that the oak pile heads had penetrated an inch into the white pine grillage logs.

⁸William Price Craighill; became Brig. General; was Chief of Engineers 1895-1897.

⁹John Newton, a Virginian who stood for the Union. Served as a combat commander during the Civil War, returning to the Corps in 1866. Was Chief of Engineers (Major General) 1884-1886.

Steam and the New Techniques

¹Jean Baptiste Marestier, *Memoir sur les Bateaux a Vapeur des Etats-Unis D'Amerique* (Paris 1824), passim.

²The qualifications of the prototype wood spans developed by Town, Burr, Long and others were well established by 1850. Initial attempts were made to meet the new load requirements by introduction of iron supplementally in the form of braces and tie rods, but the bulky timbers soon gave way to slimmer, all-metal structures.

Early Dredging

¹"Mud," the common term for Delaware River dredging spoil, is altogether too vague an appellation to afford an adequate description of the material in question. The predominant ingredients, identified in the disposal areas, are organic clay and silt, sand, peat and gravel. For hydraulic dredging, mud is differentiated from sand, as it contains appreciable quantities of carbon dioxide and methane and must be treated as a solid-water-gas mixture.

²Years later, with power equipment, the "agitation" method was used. It consisted of pumping into the dredge's hoppers during flood tide, then pumping overboard to disperse the buoyant silt on the ebb tide.

³Other Board Members were Lt. Col. W. F. Reynolds, Lt. Col. N. Michler and Capt. William Ludlow.

Haven Within the Capes

¹"The form and dimensions of the old (Delaware) breakwater were principally based upon a study of the long flat slopes of the Cherbourg breakwater, at that time (1828) the only practical example of an extensive random stone offshore breakwater. The stone was not deposited to the best advantage, as the methods of unloading then available were not such as to render an accurate emplacement possible."—Lt. Col. C. W. Raymond.

Early River and Harbor Works

¹It is not evident that appropriations were made pendant to this act.

²Length of the River is about 310 miles; its drainage area is approximately 12,765 square miles.

³Annual Report of the Chief of Engineers, FY 1873.

⁴The act was amended in 1826 to stipulate "two inches" in substitution of "one inch."

⁵United States Assistant Engineer in Philadelphia.

⁶The tide attains maximum height of six feet at Bombay Hook, assumed mouth of the Delaware River.

⁷Major C. W. Raymond, Corps of Engineers, Phila., Pa., 5 Jan. 1898 to Brig. Gen. John M. Wilson, Chief of Engineers; Annual Report FY 1898.

⁸Grievances of Delaware's riparian owners concerned the possibility that channel training dikes might obstruct inflow of the flood tide.

The United States Buys a Canal

¹In his report a year later Col. Craighill noted an unexpended balance of \$2,500.

²Resolution adopted by the Board of Public Works, State of Maryland, in Baltimore Nov. 15, 1906.

³Col. W. M. Black, Col. Frederick V. Abbot, Lt. Col. J. C. Sanford, Lt. Col. Mason M. Patrick and Maj. R. R. Raymond.

⁴The canal was purchased August 13, 1919 for \$2,514,000 as authorized by HD 196-63-1.

The Inland Waterway

¹Completed in 1825—Mount Carbon to Philadelphia, 108 miles.

²Succeeded in 1895 by Mayor Charles F. Warwick.

³Thomas Martindale, L. Y. Schermerhorn, George W. Kendrick, Jr., Edwin S. Cramp, Daniel Baugh, John Wanamaker, Elias P. Smithers, W. W. Foulkrod, Hamilton Disston and Edward Morrell.

⁴Editorial, "Carts, Boats and Rails," 30 Oct. 1911.

⁵Statement of Hon. J. Hampton Moore; Public hearing at Custom House, Philadelphia, 14 July 1937 before a special board of Army Engineers.

⁶Senate Document 139, 79th Congress.

⁷A continuous navigation route, mostly sheltered, extending 2,900 miles from Boston, Massachusetts to the Rio Grande in Texas.

⁸A Soils Research Installation of the Corps of Engineers. When the Ithaca Section was discontinued, key personnel were transferred to the Wilmington and Philadelphia Engineer Districts and there developed the basic principles of the new science of Soils Mechanics.

⁹In engineering jargon, ascending or descending grade pitch is treated in proportions, as one on five. That is: for every five feet of horizontal extension, a one on five grade descends (or ascends) one foot, e.g.

The Good Defense

¹Brig. Gen. A. Humphries, "Historical Sketch of the Corps of Engineers," *Occasional Papers*, No. 16, (Washington Barracks, D.C., 1876), passim.

²A letter dated 28 April 1776 suggests an ugly rift developing between Gridley and Washington, concerning the construction of the defences at Boston. The general writes:

"Who am I to blame for this shameful neglect but you, sir, who was to have them executed. It is not an agreeable task to be put under the necessity of putting any gentlemen in mind of his duty, but it is what I owe the public. I expect and desire, sir, that you will exert yourself in completing the works with all possible dispatch, and do not lay me under the disagreeable necessity of writing you again on this subject."

³Brig. Gen. Edward Burr, "Historical Sketch of the Corps of Engineers, United States Army 1775-1865," *Occasional Papers*, No. 71, (Fort Belvoir, July 1939), passim.

⁴J. Bennett Nolan, *The Schuylkill*, (New Brunswick, 1951), p. 215.

⁵W. F. Heavey, "The Corps in the Days of the Revolution," *Military Engineer*, XXXI, No. 180, (December 1939), p. 410.

⁶When the Philadelphia District was assigned the mission of rebuilding the fortifications at Valley Forge in 1915, it did so by comparing du Portail's map with the so-called "Spy Map" made by a Tory in British pay and submitted to Sir William Howe, British commander in Philadelphia.

⁷Capt. Francois G. Ollivier, *Le Corps du Genie Aux Etats-Unis d'Amerique Pendant la Guerre de l'Independence*, *Revue du Genie Militaire*, LI, #2 (Paris 1922), pp. 514-542.

⁸Earl I. Brown, *Historic Fort Mifflin*, (Philadelphia 1932), pp. 1-9.

⁹Nolan, *The Schuylkill*, passim.

¹⁰Humphries, *Historical Sketch*, p. 5.

¹¹Major Pierre L'Enfant, *American State Papers, Military History*, I (Washington 1832-1861), pp. 82-89; see also the report by Thomas Jefferson, "On Forts," in the same volume, pp. 192-197.

¹²The attack on the American frigate Chesapeake by the British frigate Leopard in June 1807, raised the national temperature. The British had removed and impressed 4 sailors from the Chesapeake, alleging them to be British seamen. Impressment and the emotions it roused were to be a major cause of the War of 1812.

¹³"Survey of the Works at Fort Delaware, And Proceedings of a Court-Martial on Major Babcock," *American State Papers*, 18th Congress, No. 264-communicated to the House of Representatives, 19 January 1825.

¹⁴J. St. George Joyce, ed., *The story of Philadelphia* (Philadelphia 1919), pp. 206-209.

¹⁵George Washington Cullum, "American Engineers of the War of 1812-15," *Campaigns of the War of 1812-1815* (New York 1879). passim.

¹⁶Brown, *Fort Mifflin*, p. 12.

¹⁷W. Emerson Wilson, *Fort Delaware* (Newark, Del. 1957), p. 16.

¹⁸U. S. Congress, *House Miscellaneous Document, No. 17*, 37th Congress, 2nd session, Vol. 1 (2 December 1861), pp. 1-2.

¹⁹Frank H. Taylor, *Philadelphia in the Civil War* (Philadelphia 1913), passim.

²⁰Emmanuel Raymond Lewis, *Seacoast Fortification of the United States* (Washington, D.C. 1970), passim.

²¹*Annual Reports of the Chief of Engineers* (Washington 1903; 1904; 1905), passim.

²²*Annual Reports of the Chief of Engineers* (Washington 1879), pp. 237-242.

²³D. D. Heap, *Engineer Department U. S. Army at the International Exhibition 1876* (Washington 1884), p. 299.

²⁴Wilson, *Fort Delaware*, p. 29.

²⁵Gen. Johnson Hagood, *The Services of Supply, A Memoir of the Great War* (Boston 1927), passim.

²⁶Lenore Fine and Jesse A. Remington, *United States Army in World War II. The Technical Services, The Corps of Engineers: Construction in the United States*. Washington, D.C. 1972, pp. 3-41.

²⁷Francis A. Collins, *The Fighting Engineers* (New York 1918), pp. 191-193.

²⁸Fine, *Construction*, p. 466.

²⁹*The Binnacle* (*The Binnacle* was an in-house publication of the Philadelphia Engineer District and provided excellent source material for the 1940's), Vol. III, #2, (1942), passim.

³⁰"Resume of Accomplishments of Philadelphia Engineer District as of January 1944"—forwarded to OCE 14 January 1944.

³¹"Ibid," p. 4.

³²*The Binnacle* (October 1941), Vol. II, No. 10, pp. 18-19.

³³*The Binnacle*, passim.

³⁴Much of the information dealing with military construction from the Second World War through the termination of the District's mission in that context, on 1 July 1960, has been obtained through interviews with past and present District employees.

³⁵*The Binnacle* (August 1947), Vol. 9, No. 8, pp. 7-8.

³⁶U. S. Army Corps of Engineers, *McGuire-Dix Area* (Philadelphia 1960), passim.

³⁷*History of Project at Birdsboro Ordnance Depot, Birdsboro, Pa.* (Philadelphia 1956), passim.

³⁸Records of the Philadelphia Engineer District.

³⁹Records of the Philadelphia Engineer District.

⁴⁰Records of the Philadelphia Engineer District.

⁴¹*Capehart Family Housing, Fort Dix, N. J.* (Philadelphia 1960), passim.

⁴²Records of the Philadelphia Engineer District.

A Wagon Provided For the Purpose

¹*Pennsylvania Magazine*, Vol XXXIX, No. 3, 1915, pp. 375-76.

²Cullum, *American Engineers*, pp. 20-4.

³Byt. Capt. Gustavus W. Smith, "Company A, Corps of Engineers, U. S. A., in the Mexican War, 1846-48," *Occasional Papers*, No. 16 (Washington Barracks, D. C., 1904), p. 109.

⁴J. Mayhew Wainwright, Assistant Secretary of War, "Lecture on Mass Procurement," delivered at the Army War College, G-4, Course No. 10, (Washington, D. C., 20 January 1904), p. 109.

⁵*Ibid.*, pp. 22-23.

⁶Isaac F. Marcossou, S.O.S., *America's Miracle in France*, (New York, 1919), passim.

⁷Hagood, *Memoir*, passim.

⁸Much of the material relating to World War I and in general to the period 1917 to 1939 has been extracted from the official records and correspondence files of the Philadelphia Engineer District.

⁹Wainwright, p. 25.

¹⁰*Directory of Field Agencies Engaged in Procurement Planning*, (Washington, 1923), pp. 12-14.

¹¹*The Binnacle*, Vol. 1 (July, 1940).

¹²*The Binnacle*, Vol. 5 (November, 1944).

¹³*The Binnacle*, Vol. 6 (August, 1945).

¹⁴Letter from the Office of the Chief of Engineers to the Division Engineer, North Atlantic Division.

¹⁵Blanche D. Coll, Jean E. Keith, and Herbert H. Rosenthal. *United States Army in World War II. The Technical Services. The Corps of Engineers: Troops and Equipment* (Washington, D.C., 1958), pp 177-78.

¹⁶Presentation by Chief, Marine Design Division, September 1971, p. 15.

¹⁷Four (4) new 300/700 YD militarized hopper dredges were built by the Philadelphia District: The *Lyman, Barth, Davison, and Hyde*. The five older dredges which were completely militarized at the District were the *Rossel, Marshall, Harding, Hains, and Hoffman*.

¹⁸*The Binnacle* Vol. 6 (September, 1945).

¹⁹An interesting attempt at expediting the flow of supplies, the Industrial Mobilization Planning Program was doomed to failure, since its officers did not possess letter contracting authority, and the firms contacted were frequently undercut in open competitive bidding, invalidating the program's effectiveness.

²⁰The treatment of the Military Supply Programs during and after the Korean Conflict is largely based on District records and on interviews with District personnel who participated in these programs.

²¹Colonel E. P. Yates, "USAHOME," *The Military Engineer*, November-December 1965, p. 414.

Dredging the Delaware

¹Approximate annual inflow of solids from the uplands: 2,166,000 tons; (U. S. Geological Survey report: "Sedimentation Processes in Estuaries," 1965.).

²State of Pennsylvania dredging project authorized under Pennsylvania Assembly Act 441, the Desilting Act, 1945. The Federal Government aided the project financially.

³A consortium of eleven major oil companies, organized as the Delaware Bay Transportation Company.

⁴"The terminal would consist of a marginal wharf, located about six miles offshore near Big Stone Beach, Delaware, to accommodate 250,000 DWT tankers."—(Long Range Spoil Disposal Study, Substudy 6, page 9-a).

Marine Design—Unique Mission

¹Authorized in ER 10-1-3, Appendix XX.

The Valley Report

¹The "308 surveys," defined in the report of the Chief of Engineers, published as House Document 308, 69th Congress, 2nd Session, 1927.

²House Document 179, 73rd Congress, 2nd Session; one of eight basin studies made under the "308" authorizations.

³Essentially, a process of free discussion and quiet thinking which does not admit the authority of a majority; all decisions are made on the basis of unanimity, reached by a process which considers the opinion of every person. The Committee retained the procedure throughout its term of service.

⁴Renamed Francis E. Walter Dam 8 July 1963 to honor the Pennsylvania Congressman whose considerable efforts aided the enactment of legislation authorizing the Lehigh River Basin Flood Control Plan.

⁵President Dwight D. Eisenhower to secretary Wilbur M. Brucker; the White House, Washington; 22 October 1956.

Big Storms—Big Floods

¹Major General F. P. Koisch, Corps of Engineers; Director of Civil Works Division, Office of the Chief of Engineers.

The Dams and Recreation

¹"Reservoir" and "Lake" are terms used interchangeably to designate the pool created by the impoundment of a dam. As of 1970, the officially assigned term for Corps of Engineers projects is "Lake."

Appendix IV—Iron Pier

¹Engineer Major Hartman Bache was an early proponent of wrought iron screw piles for offshore foundation structures. His plan for an ice harbor at Reedy Island was rejected for budgetary considerations in 1852, but the Lighthouse Board adopted his innovation for many of their structures in the Delaware Bay and Chesapeake Bay areas.

²In 1793, Philadelphia's population of 40,000 was reduced ten percent by yellow fever. The disease reached epidemic proportions again in 1802 and 1820, and cholera was rampant in Philadelphia in 1832.